

Bats (Mammalia: Chiroptera) of Mata do Paraíso research station, Viçosa, Minas Gerais, Brazil

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ABSTRACT: The aim of this study was to document the records of bat species collected at the Estação de Pesquisa Treinamento e Educação Ambiental (EPTEA) da Mata do Paraíso, a small fragment of Atlantic Rainforest of 200 ha in Viçosa, Minas Gerais, Brazil. Original data was obtained by capture sessions with mist nets from November 2007 to October 2008, and complemented with material from the collection database of Museu de Zoologia João Moojen, Universidade Federal de Viçosa. We found a total of 17 bat species distributed in five families at the EPTEA Mata do Paraíso.

INTRODUCTION

Information on distribution and diversity of Brazilian species is still scarce (Gregorin *et al.* 2008, Tavares *et al.* 2010, Bernard *et al.* 2011), with most studies concentrated in the southeastern region (Esberárd and Bergallo 2005). The state of Minas Gerais harbors about 55% of the bat diversity currently known in Brazil. On the other hand, all the three biomes that occur in Minas Gerais (Atlantic Forest, Caatinga and Cerrado) are undersampled, and the highly fragmented Atlantic Forest occurring today in Minas Gerais has been particularly poorly sampled for bats (Tavares *et al.* 2010).

The municipality of Viçosa is nested within the Atlantic Forest domains of southern Minas Gerais state, and has been considered a priority area for the conservation of mammals in the state (Drummond *et al.* 2005). There are several small forest fragments surrounding Viçosa, and the largest is the Mata do Paraíso (384 ha.), where is located the Estação de Pesquisa, Treinamento e Educação Ambiental (EPTEA) Mata do Paraíso (194 ha) (Ribon 2005). Inventories of non-volant small mammals (Rodentia and Marsupialia) have been conducted in EPTEA (Paglia *et al.* 1995; Lessa *et al.* 1999; Gonçalves and Oliveira 2004; Percequillo *et al.* 2004), but no inventories of bats for the area have been published to date. This is the first survey of the bat fauna of the EPTEA Mata do Paraíso, conducted to filling in one of the gaps of knowledge of bat species distribution within Minas Gerais.

MATERIALS AND METHODS

The inventory was carried out at the Estação de Pesquisa, Treinamento e Educação Ambiental (EPTEA) Mata do Paraíso (20°46'–20°50' S, 42°51'–42°49' W), Viçosa, Minas Gerais (Figure 1).

The EPTEA Mata do Paraíso was formerly a farmland (Fazenda Paraíso), and a highly the fragmented area owe to timber, use of the lands for livestock, and coffee plantations. Since 1966, the fragment have been protected by the Departamento de Engenharia Florestal of the Universidade Federal de Viçosa, and hunting and timber removal ceased, but cattle invasions still occurred until the

last decade. Currently, EPTEA Mata do Paraíso has been used for educational purposes, and scientific research (Ribon 2005).

The climate of the EPTEA Mata do Paraíso is Cwa, mesothermic humid with rainy summers and dry winters (Vianello and Alves 1991). The average rainfall is 1340 mm, the dry season (winter) occurs from May to September, and the wet season (summer) is from December to March (Vianello and Alves 1991). The average annual humidity is 80%, and the average annual temperature 19°C, ranging between 14°C to 26°C (Castro *et al.* 1983). The region has elevations between 690 m and 870 m (Ribon 2005).

The EPTEA Mata do Paraíso's original vegetation was categorized as Semideciduous Montane Forest by Pereira *et al.* (2001), Meira-Neto and Martins (2002), Higuchi *et al.* (2006), and Pinto *et al.* (2007), with intermediate to advanced stages of secondary succession, with a mosaic of vegetation ranging from sparse vegetation to dense semideciduous forests (Paglia *et al.* 1995).

We sampled bats from three selected sites: a site with secondary forest in advanced stages of regeneration, a site with molasses grass and a site with secondary forest in early stages of regeneration ("capoeira"), totaling 10 sampling points (Table 1). More than one point was sampled by night, and sampling effort was not equally distributed for each area.

Samplings were carried out every two months, for three consecutive nights, near the new moon, from November 2007 to October 2008 (permit no. 10881-1 by IBAMA/MMA). The total sampling effort was 5880 m².h (Straube and Bianconi 2002). Three mist nets (measuring 7 x 2.5, 9 x 2.5 and 12 x 2.5 m) were set close to food sources, water bodies, flight routes and potential shelters, from sunset to midnight, and inspected at 20-minute intervals. Captured bats were placed in cotton bags, and biological information such as species identification, weight, sex, reproductive status and forearm measurements, was taken for each individual. Voucher specimens were deposited in the Mastozoology Collection of Museu de Zoologia João Moojen of the Universidade Federal de Viçosa (MZUFV).

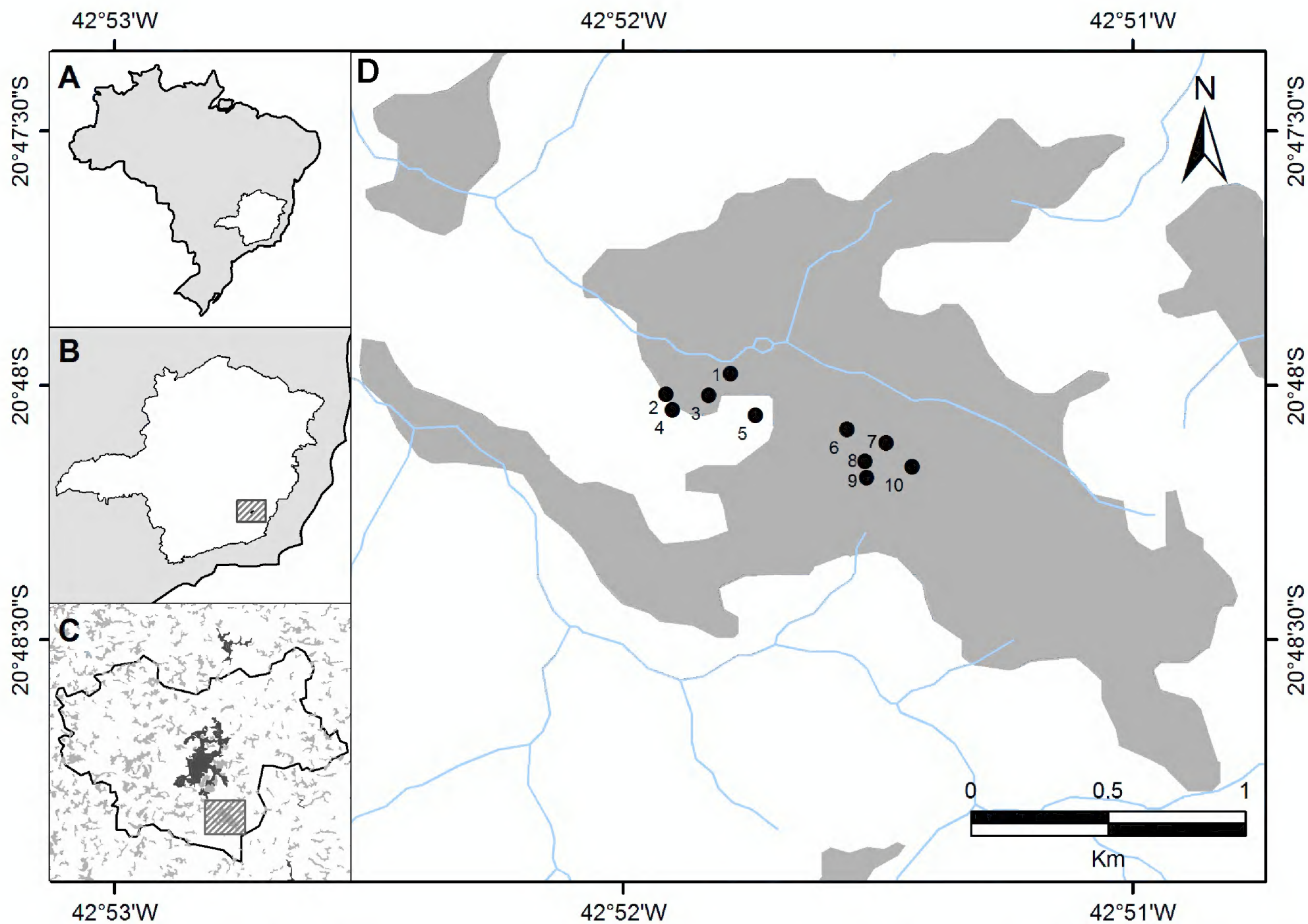


FIGURE 1. A) Map of Brazil with the state of Minas Gerais in the detail, B) Location of Viçosa in Minas Gerais, C) Limits of the municipality of Viçosa; black - urban area and gray - forest fragments, hatched - fragment of Atlantic Forest, of which the EPTEA Mata do Paraíso is part, D) Sampling sites.

TABLE 1. Sampling sites of bats in EPTEA Mata do Paraíso. Legend: CAP (Capoeira), MG (Molasses grass) and SF (Secondary forest).

SAMPLING SITES	LONGITUDE (W)	LATITUDE (S)	ALTITUDE	ENVIRONMENT	SAMPLING EFFORT (M ² .H)
1	42°51'47"	20°47'59"	738m	CAP	1260
3	42°51'50"	20°48'01"	726m	CAP	
2	42°51'55"	20°48'01"	716m	MG	
4	42°51'54"	20°48'03"	710m	MG	600
5	42°51'44"	20°48'04"	742m	MG	
6	42°51'34"	20°48'05"	729m	SF	
7	42°51'29"	20°48'07"	734m	SF	4020
8	42°51'32"	20°48'09"	750m	SF	
9	42°51'32"	20°48'09"	751m	SF	
10	42°51'26"	20°48'10"	748m	SF	

Taxonomy followed published keys and descriptions (Vizotto and Taddei 1973; Nowak 1994; Emmons and Feer 1997; Gregorin and Taddei 2002; Haynes and Lee Jr. 2004; Velazco 2005 and Gardner, 2008).

We estimated species richness based on the data observed using Jackknife 1 as implemented in the software EstimateS 7.0. Each sampling night (n=14) was considered a sample unit.

RESULTS AND DISCUSSION

Including the new data collected and museum vouchers, a total of 17 species belonging to five families were recorded for EPTEA Mata do Paraíso. We recorded eleven species, and 145 captures (Table 2). Six species (*Anoura geoffroyi*, *Micronycteris* cf. *megalotis*, *Platyrrhinus helleri*,

Eptesicus brasiliensis, *Rhynchonycteris naso* and *Noctilio leporinus*) have been recorded in previous inventories and voucher specimens are deposited in the Mastozoology Collection of the Museu de Zoologia João Moojen.

The family Phyllostomidae was the most representative, with 64.7% (11 species) of all the bat species in the area, followed by Vespertilionidae (three species) and Emballonuridae, Molossidae and Noctilionidae (one species each). It has been largely documented that Phyllostomidae is the most commonly represented family in bat inventories using mist-nets (e.g. Bernard 2001; Bianconi *et al.* 2004; Bordignon 2006, Simmons and Voss 1998). Phyllostomidae is also the most diverse family of Neotropical bats (Fenton *et al.* 1992) and the larger number of phyllostomids captured in comparison

with captures of bats from other families is also observed considering only animals captured during this study (72.7% of the specimens captured).

Two species were predominant in the sampled area, with more than half of all captures: *Artibeus lituratus* (31.9% of specimens) and *Sturnira lilium* (27%), both fruit bats tolerant to areas with anthropic impact (Passos et al. 2003).

The number of currently recorded species for EPTEA Mata do Paraíso (17 spp.) corresponds to 22% of the bats identified for the state of Minas Gerais (Tavares et al. 2010). Estimates (Jackknife) pointed to 11.9 species (SD = 2.01) for the EPTEA Mata do Paraíso, a close value

compared to the observed data (n = 11) (Figure 2). Despite the small sampling effort of this study, the richness found was similar to that found in other studies with greater sampling effort (e.g. Pedro and Taddei 1997; Falcão et al. 2003; Barros et al. 2006; Moreira et al. 2008; Nobre et al. 2009; Bruno et al. 2011).

This study add information on bats to the knowledge of the mammalian fauna in the EPTEA Mata do Paraíso, a significant remnant of Atlantic forest in the state of Minas Gerais, which is now known to harbor 17 species of bats, 17 small non-volant mammals (Lessa et al. 1999) and 23 medium- and large-sized mammals (Prado et al. 2008).

TABLE 2. Species of bats and number of specimens recorded in EPTEA Mata do Paraíso. Collection = number of specimens collected and deposited in MZUFV before (1970's to 1990's) and after (2009 and 2010) the present study; Captured = number of specimens found during present study; CAP = Capoeira; MG = Molasses grass; SF = Secondary forest.

TAXON	COLLECTION	CAPTURE		
		CAP	MG	SF
Emballonuridae				
<i>Rynchonycteris naso</i> (Wied-Neuwied, 1820)	1♀	-	-	-
Phyllostomidae				
<i>Anoura caudifer</i> (E. Geoffroy, 1818)	-	-	-	1♀ - 1♂
<i>Anoura geoffroyi</i> Gray, 1838	1♂	-	-	-
<i>Artibeus fimbriatus</i> Gray, 1838	2♂	1♀	-	4♀ - 3♂
<i>Artibeus lituratus</i> (Olfers, 1818)	10♀ - 8♂	1♀ - 3♂	-	30♀ - 12♂
<i>Carollia perspicillata</i> (Linnaeus, 1758)	1♂	1♂	-	8♀ - 8♂
<i>Micronycteris</i> cf. <i>megalotis</i> (Gray, 1842)	1♀ - 1♂	-	-	-
<i>Platyrrhinus lineatus</i> (Thomas, 1901)	1♀	2♂	-	1♀ - 6♂
<i>Plathirrhinus helleri</i> (Peters, 1866)	1♂	-	-	-
<i>Phyllostomus hastatus</i> (Pallas, 1767)	-	-	-	2♂
<i>Pygoderma bilabiatum</i> (Wagner, 1843)	2♀	2♀ - 1♂	-	-
<i>Sturnira lilium</i> (E. Geoffroy, 1810)	12♀ - 9♂	6♀ - 2♂	3♀	10♀ - 13♂
Molossidae				
<i>Molossus molossus</i> (Pallas, 1766)	-	1♀	-	-
Vespertilionidae				
<i>Eptesicus brasiliensis</i> (Desmarest, 1819)	3♂	-	-	-
<i>Histiotus velatus</i> (I. Geoffroy, 1824)	-	-	-	1♀
<i>Myotis nigricans</i> (Schinz, 1821)	5♂	6♂	-	1♀ - 14♂
Noctilionidae				
<i>Noctilio leporinus</i> (Linnaeus, 1758)	-	1♂	-	-
Total individuals	27♀ - 31♂	11♀ - 16♂	3♀	56♀ - 59♂

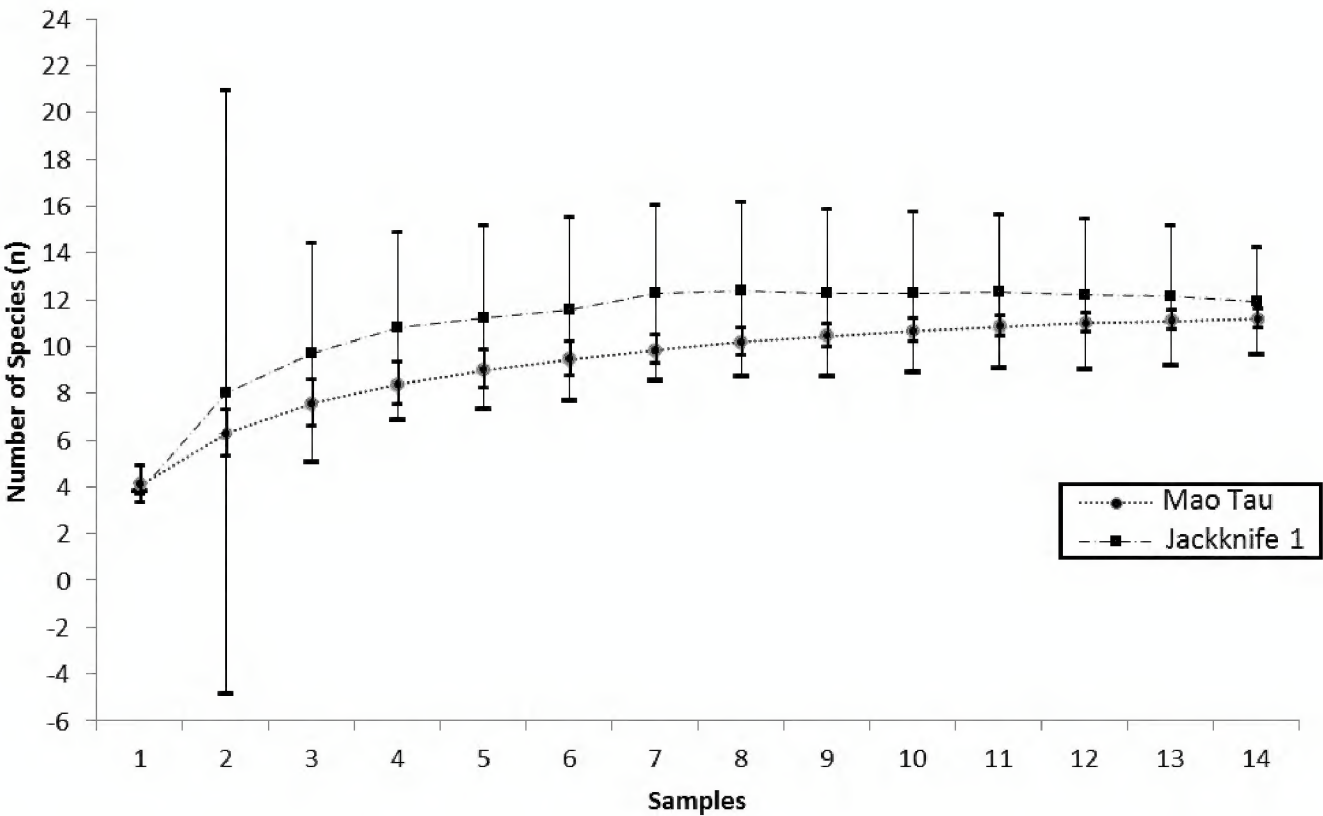


FIGURE 2. Curves for observed and expected richness for bat species sampled at EPTEA Mata do Paraíso, Viçosa, MG, Brazil.

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LITERATURE CITED

- Barros, R.S.M., E.L. Bisaggio and R.C. Borges. 2006. Morcegos (Mammalia, Chiroptera) em fragmentos florestais urbanos no município de Juiz de Fora, Minas Gerais, Sudeste do Brasil. *Biota Neotropica* 6 (1): 1-6.
- Bernard, E. 2001. Species list of bats (Mammalia, Chiroptera) of Santarém area, Pará State, Brazil. *Revista Brasileira de Zoologia* 18 (2): 455-463.
- Bernard, E., V.C. Tavares and E. Sampaio. 2011. Compilação atualizada de morcegos (Chiroptera) para a Amazônia Brasileira. *Biota Neotropica* 11 (1): 35-46.
- Bianconi, G.V., S.B. Mikich, and W.A. Pedro. 2004. Diversidade de morcegos (Mammalia, Chiroptera) em remanescentes florestais do município de Fênix, noroeste do Paraná, Brasil. *Revista Brasileira de Zoologia* 21(4): 943-954.
- Bordignon, M.O. 2006. Diversidade de morcegos (Mammalia, Chiroptera) do complexo Aporé-Sucuruí, Mato Grosso do Sul. Brasil. *Revista Brasileira de Zoologia* 23 (4): 1002-1009.
- Bruno, M., F.C. Garcia and A.P.G.D. Silva. 2011. Levantamento da quiropterofauna do Parque Municipal Fazenda Lagoa do Nado, Belo Horizonte, MG, Brasil. *Chiroptera Neotropical* 17 (1): 877-884.
- Castro, P.S., O.F. Valente, D.T. Coelho and R.S. Ramalho. 1983. Interceptação da chuva por mata natural secundária na região de Viçosa, MG. *Revista Árvore* 7 (1): 76-89.
- Drummond, G.M., Martins, C.S., Machado, A.B., F.A. Sebaio and Y. Antonini. 2005. *Biodiversidade em Minas Gerais: um Atlas para sua conservação*. Belo Horizonte: Fundação Biodiversitas. 20 p.
- Emmons, L.H. and F. Feer. 1997. *Neotropical Rainforest Mammals: a Field Guide*. Chicago: University of Chicago Press. 396 p.
- Esbérard, C.E.L. and H.G. Bergallo. 2005. Research on bats in the state of Rio de Janeiro, southeastern Brazil. *Mastozoologia Neotropical* 12 (2): 237-243.
- Falcão, F.C., V.F. Rebelo and S. A. Talamoni. 2003. Structure of a bat assemblage (Mammalia, Chiroptera) in Serra do Caraça Reserve, South-east Brazil. *Revista Brasileira de Zoologia* 20(2): 347-350.
- Fenton, M.B., L. Acharya, D. Audet, M.B.C. Hickey, C. Merriman, M.K. Obrist and D.M. Syme. 1992. Phyllostomid bats (Chiroptera: Phyllostomidae) as indicators of habitat disruption in the Neotropics. *Biotropica* 24(3): 440-446.
- Gardner, A.L. 2008. *Mammals of South America*. Vol. 1. Chicago and London: University Of Chicago Press. 669 p.
- Gonçalves, P.R. and J.A. Oliveira. 2004. Morphological and Genetic Variation between two Sympatric forms of *Oxymycterus* (Rodentia: Sigmodontinae): na Evaluation of Hypotheses of Differentiation within the genus. *Journal of Mammalogy* 85(1):148-161.
- Gregorin, R. and V.A. Taddei. 2002. Chave artificial para a identificação de molossídeos brasileiros (Mammalia, Chiroptera). *Mastozoologia Neotropical* 9 (1): 13-32.
- Gregorin, R., A.P. Carmignotto and A.R. Percequillo. 2008. Quirópteros do Parque Nacional da Serra das Confusões, Piauí, nordeste do Brasil. *Chiroptera Neotropical* 14(1): 366-383.
- Haynes, M.A. and T.E. Lee Jr. 2004. *Artibeus obscurus*. *Mammalian Species* 752: 1-5.
- Higuchi, P. Reis, M.G.F., Reis, G.G. Pinheiro, A.L.C.T. Silva, and C. H. R.Oliveira. 2006. Composição florística da regeneração natural de espécies arbóreas ao longo de oito anos em um fragmento de Floresta Estacional Semidecidual, em Viçosa, MG. *Revista Árvore* 30 (6): 893-904.
- Lessa, G., Gonçalves, P.R., Morais-Junior, M.M., Costa, F.M., R.F. Pereira and A.P. Paglia. 1999. Caracterização e monitoramento da fauna de pequenos mamíferos terrestres de um fragmento de mata secundária em Viçosa, Minas Gerais. *BIOS*, 7 (7): 41-49.
- Meira-Neto, J.A.A. and F.R. Martins. 2002. Composição florística de uma Floresta Estacional Semidecidual Montana no município de Viçosa-MG. *Revista Árvore* 26 (4): 437-446.
- Moreira, J.C., Manduca, E.G., Gonçalves, P.R., Stumpp, R., C.G.C. Pinto and G. Lessa. 2008. Mammals, Volta Grande Environmental Unity, Triângulo Mineiro, states of Minas Gerais and São Paulo, Southeastern Brazil. *Check List* 4(3): 349-357.
- Nobre, P.H., Rodrigues, A.S, Costa, I.A., A.E.S. Moreira and H.H. Moreira. 2009. Similaridade da fauna de Chiroptera (Mammalia), da Serra Negra, municípios de Rio Preto e Santa Bárbara do Monte Verde, Minas Gerais, com outras localidades da Mata Atlântica. *Biota Neotropica* 9 (3): 151-156.
- Nowak, R.M. 1994. *Walker's bats of the world*. Chicago: The Johns Hopkins University Press. 288 p.
- Paglia, A.P., De Marco-Junior, P., Costa, F.M., R.F. Pereira and G. Lessa. 1995. Heterogeneidade estrutural e diversidade de pequenos mamíferos em um fragmento de mata secundária de Minas Gerais, Brasil. *Revista Brasileira de Zoologia* 12(1): 69-79.
- Passos, F.C., W.R. Silva, W.A. Pedro and M.R. Bonin. 2003. Frugivoria em morcegos (Mammalia, Chiroptera) no Parque Estadual Intervalles, sudeste do Brasil. *Revista Brasileira de Zoologia* 20 (3): 511-517.
- Pedro, W.A. and V.A. Taddei. 1997. Taxonomic assemblage of bats from Panga Reserve, Southeastern Brazil: abundance patterns and trophic relations in the Phyllostomidae (Chiroptera). *Boletim do Museu de Biologia Mello Leitão*, 6: 3-21.
- Percequillo, A.R., P.R. Gonçalves and J.A. Oliveira. 2004. The rediscovery of *Rhagomys rufescens* (Thomas, 1886), with a morphological redescription and comments on its systematic relationships based on morphological and molecular (cytochrome b) characters. *Mammalian Biology* 69 (4): 238-257.
- Pereira, R. A., Reis, G. G., M.G.F. Reis and R. S. Brites. 2001. Caracterização de paisagem, com ênfase em fragmentos florestais, no município de Viçosa, Minas Gerais. *Revista Árvore* 25 (3): 327-333.
- Pinto, S.I.C., Martins, S.V., Silva, A.G., Barros, N.F., H.C.T. Dias and L.M. Scoss. 2007. Estrutura do componente arbustivo-arbóreo de dois estádios sucessionais de Floresta Estacional Semidecidual na Reserva Florestal Mata do Paraíso, Viçosa, MG, Brasil. *Revista Árvore* 31 (5): 823-833.
- Prado, M.R., E. C. Rocha and G. M. L. del Giúdice. 2008. Mamíferos de médio grande porte em um fragmento de Mata Atlântica, Minas Gerais, Brasil. *Revista Árvore* 32 (4): 741-748.
- Ribon, R. 2005. Demarcação de uma grade de trilhas no centro de pesquisa da Mata do Paraíso, Viçosa, Minas Gerais. *Revista Árvore* 29(1): 151-158.
- Simmons, N.B. and R.S. Voss. 1998. The mammals of Paracou, French Guiana: a neotropical lowland rainforest fauna. *Part I. Bats. Bulletin of the American Museum of Natural History*, 273: 1-219.
- Straube, F. C. and G. V. Bianconi 2002. Sobre a grandeza e a unidade utilizada para estimar esforço de captura com utilização de redes-de-neblina. *Chiroptera Neotropical* 8(1-2): 150-152.
- Tavares, V.C., Aguiar, L.M.S., Perini, F.A., F.C. Falcão and R. Gregorin. 2010. Bats of the state of Minas Gerais, southeastern Brasil. *Chiroptera Neotropical* 16(1): 675-705.
- Velazco, P.M. 2005. Morphological Phylogeny of the Bat Genus *Platyrrhinus* Saussure, 1860 (Chiroptera:Phyllostomidae) with the Description of Four New Species. *Fieldiana: Zoology, N.S.* 105: 1-54.
- Vianello, R.L. and A.R. Alves. 1991. *Meteorologia Básica e Aplicações*. Viçosa: Editora UFV. 449p.
- Vizotto, L.D. and V.A. Taddei. 1973. *Chave para determinação de quirópteros brasileiros*. São José do Rio Preto: Editora da UNESP. 72 p.

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APPENDIX 1. Specimens examined: *Anoura caudifer* (MZUFV 2545♀, 2693♂), *Anoura geoffroyi* (MZUFV 1475♂), *Artibeus fimbriatus* (MZUFV 1527♂, 1529♂, 2543♂, 2548♀, 2598♀, 2600♀, 2672♂, 2683♀, 2756♂), *Artibeus lituratus* (MZUFV 1479♂, 1484♀, 1485♀, 1487♀, 1492♀, 1494♀, 1496♀, 1511♂, 1512♂, 1513♂, 1516♀, 1517♀, 1521♂, 1522♀, 1523♂, 1525♀, 1532♂, 1533♂, 2534♂, 2537♀, 2540♂, 2541♀, 2549♀), *Carollia perspicillata* (MZUFV 352♂, 2542♂, 2544♂, 2547♂, 2550♂, 2585♂, 2596♀, 2597♀, 2599♂, 2602♀, 2664♂, 2670♂, 2671♀, 2694♂, 2695♀, 2759♀), *Eptesicus brasiliensis* (MZUFV 216♂, 1546♂, 3159♂), *Histiotus velatus* (MZUFV 2755♀), *Micronycteris cf. megalotis* (MZUFV 114♂, 115♀), *Molossus molossus* (MZUFV 2691♀), *Myotis nigricans* (MZUFV 1472♂, 1473♂, 1474♂, 1491♂, 1493♂, 2528♂, 2535♂, 2536♂, 2538♂, 2586♂, 2587♂, 2593♀, 2665♂, 2666♂, 2667♂, 2668♂, 2669♂, 2757♂), *Noctilio leporinus* (MZUFV 3145♂), *Phyllostomus hastatus* (MZUFV 2754♂, 2758♂), *Platyrrhinus helleri* (MZUFV 1520♂), *Platyrrhinus lineatus* (MZUFV 1480♀, 2529♀, 2529♂, 2530♂, 2539♂, 2584♂, 2588♂, 2601♂, 2663♂, 2673♂), *Pygoderma bilabiatum* (MZUFV 1481♀, 2680♀, 2681♂, 2682♀), *Rhynchonycteris naso* (MZUFV 1542♀), *Sturnira lilium* (MZUFV 1470♀, 1471♂, 1476♂, 1477♂, 1478♀, 1488♀, 1489♀, 1490♂, 1495♂, 1497♂, 1514♀, 1515♂, 1518♀, 1519♀, 1528♂, 1530♀, 1531♀, 1543♀, 1544♀, 1545♀, 1554♂, 2676♂, 2531♀, 2532♂, 2533♂, 2546♂, 2589♂, 2590♀, 2591♀, 2594♂, 2595♀, 2663♀, 2674♀, 2675♂, 2677♂, 2684♀, 2692♂, 2760♂).